PASPORT™

PS-2129

Exercise Heart Rate Sensor

Sensor Specifications:

Heart rate range:	40 to 240 beats per minute
Transmitter range:	approximately 1 meter
Resolution:	1 beat per minute
Accuracy:	1 beat per minute
Default sample rate:	1 sample every 5 seconds
Max. sample rate*:	5 samples per second
Averaging interval*:	5 seconds

*The Exercise Heart Rate Sensor averages the heart rate in 5-second intervals. Changing the sampling rate of this sensor is not recommended. For a beat-by-beat display, use a PS-2111 EKG Sensor.

Heart Rate Quick Start

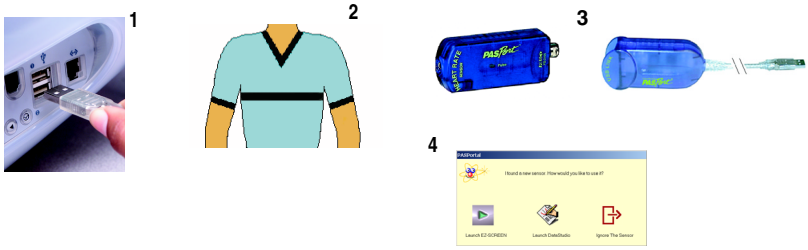
The PS-2129 Exercise Heart Rate Sensor uses a chest transmitter and sensor (receiver) to measure heart rates between 40 and 240 beats per minute.

Additional Equipment Needed

- PASPORT™ interface (USB Link (PS-2100) with USB-compatible computer, **Xplorer** (PS-2000), etc.)
- EZscreen or DataStudio® software (version 1.7 or later)

Equipment Setup

1. Connect the USB Link to a USB port on your computer or to a USB hub. (If using an **Xplorer** with a computer in the classroom, connect the **Xplorer** cable to the USB port on your computer.)
2. Wrap the transmitter belt around your chest. (Follow the instructions on card 2A.)
3. Connect the sensor to the PASPORT interface (USB Link, **Xplorer**, etc.).
4. The software launches when it detects a PASPORT sensor. Select a choice from the PASPORTAL window.



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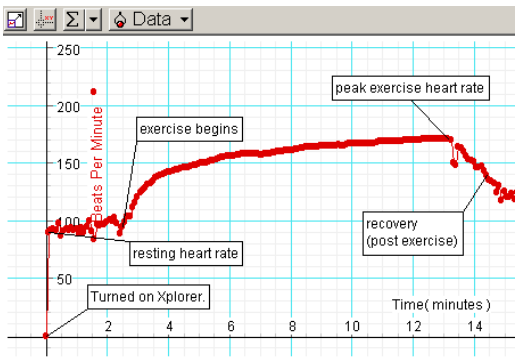
Heart Rate Changes During and After 14 Minutes of Exercise at a Constant Intensity and Workload



DataStudio/DS Lite Tasks:

Record the heart rate:	On the main toolbar, click the **Start** (Start) button.
View the heart rate (bpm):	From the Data list, drag the Heart Rate icon to an open display.
Scale to fit the data:	Click the **Scale-to-Fit** () button.
Retrieve Xplorer data into DataStudio:	Connect the **Xplorer** cable to **Xplorer** and to a USB port on your computer. When the computer prompts you, click **Retrieve Now** (Retrieve Now).

Heart Rate Activity

1. With the transmitter belt on, connect the Exercise Heart Rate Sensor to a USB Link or **Xplorer**. (For belt placement instructions, see card 2A.)
2. Use Table 1 below to estimate your target exercise training range.
3. Place the Exercise Heart Rate Sensor in your hand or on a table. (For sensor placement options, see card 2A.)
4. Sit in a chair. In DataStudio or **Xplorer**, click the **Start** button and record your resting heart rate for 30 seconds.
5. Stand up. In the display, watch your heart rate change.
6. Run in place for 3 to 5 minutes. Continue to collect data and try to stay within your estimated heart rate range.
7. Stop running. In the display, watch your heart rate recover for 5 - 10 minutes. Click the **Stop** button.
8. From the Graph display, record and compare your resting heart rate, maximum heart rate, and recovery (1, 2, and 3 minutes post-exercise) heart rates.

Table 1: Recommended Exercise Training Heart Rate Levels[1]

Age	Maximum Heart Rate*	Minimum Training Threshold**	Maximum Training Threshold***
15	205	123‘	185
20	200	120	180
25	195	117	176
30	190	114	171

[1]Ranges are based on the American College of Sports Medicine recommendations for healthy individuals. Ranges may vary for those with medical conditions.

*Maximum estimated heart rate is calculated from 220 - age (yrs).

**Minimum training theshold is equal to 60% of the maximum heart rate (bpm).

***Maximum training threshold is equal to 90% of the maximum heart rate (bpm).

Wearing the Transmitter Belt

The Polar® Transmitter Belt wraps around your chest and transmits the electrical signal from your heart beat to the Heart Rate Sensor. *(A proper fitting belt is essential to the sensor detecting an accurate pulse reading.)* To collect data with the Exercise Heart Rate Sensor, you must use the transmitter belt in one of the ways described below.

a) Before using the belt, moisten the electrodes on the underside of the transmitter belt (**Figure 1)** with water or a mild salt solution.

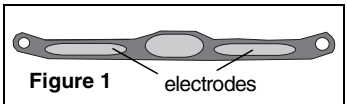


Figure 1

b) Hook one end of the transmitter belt to the elastic strap and wrap around the upper part of your rib cage **(Figure 2)**. (Note: For best accuracy, wear the belt so that the electrode makes direct skin contact.) **c)** Hook the other end of the belt to the strap. **d)** Adjust the elastic strap until the belt fits snugly around your chest. If the belt restricts breathing, loosen the strap.

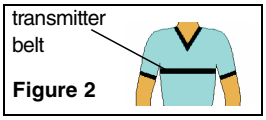


Figure 2

Other Belt Placement Options

a) Hold the belt with both hands, such that the upper palm of each hand touches each electrode. (With this placement, the data quality may vary over a wide range.) **b)** To use around the chest over the top of a t-shirt or tank top (in the upper rib cage area), wrap the belt, then wet the shirt beneath the electrodes.

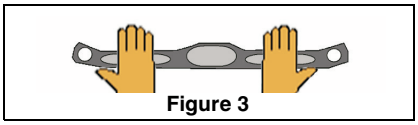


Figure 3

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Sensor Placement Options

The Exercise Heart Rate Sensor operates like a receiver, picking up signal transmission from the transmitter belt. To optimize signal reception, keep the sensor in a vertical orientation on the front of the body and within 1 meter of the transmitter belt (See "Sensor Usage Tips" on Card 2B). Keep the sensor away from computers and electrical devices. You can place the sensor in any of the following positions (a-d below):

a) Hold in hand: Connect the sensor plug to an **Xplorer** or PASPORT Extension Cable and hold in one hand.

b) Put in a case strapped to the body: Place the Exercise Heart Rate Sensor, **Xplorer**, and **Xplorer** Cable inside the **Xplorer** Carrying Case (PS-2099). Loop the **Xplorer** strap (or a waist belt for a more snug fit) through the case. Move the case to the front or side of the hip or waist. Using the PASPORT Extension Cable (514-07281), connect the sensor to the **Xplorer**.

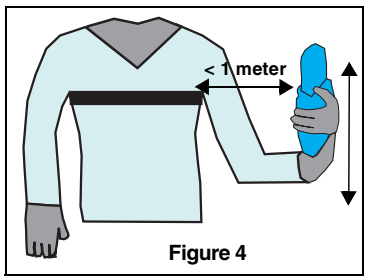

Figure 4

c) Attach to upper arm: Place the sensor on the left upper arm (in a vertical orientation) and hold in place with a strap, the **Xplorer** lanyard, or rubberbands. Using the PASPORT Extension Cable, connect the sensor to **Xplorer** or a USB Link. If using an **Xplorer**, place the **Xplorer** in a backpack or case strapped to the body.

d) Place on a table/desk: Place the sensor on a non-conductive surface, such as a wood table.

Collecting Data

1) With the transmitter belt on, plug the Exercise Heart Rate Sensor into a PASPORT interface (**Xplorer**, USB Link, etc.).

2) In DataStudio or EZscreen, click the **Start** button to begin collecting data. (If using an **Xplorer**, wait for the heart rate to appear in the liquid display screen before pressing the **Start** button.)

Note: The light on the Exercise Heart Rate Sensor will begin flashing at the pulse rate; this indicates adequate signal reception.

Transmitter Belt Maintenance

- The Polar® Transmitter Belt can be washed with a mild soap solution. Always wash and dry the belt after each use. Salt that remains on the belt for extended periods can cause an electrical short in the transmitter and reduce battery life.
- The Transmitter Belt contains a non-rechargeable battery and will last for approximately 2500 hours of wear or use. The battery is not replaceable. When the battery ceases to operate, you must purchase a new Transmitter Belt (PS-2512).

Tips for Using the Exercise Heart Rate Sensor

- Always keep the sensor within one meter (3 feet) of the transmitter belt, upright, and in a vertical orientation relative to the belt. *Avoid placing the sensor in a horizontal or tilted orientation or on the back side of the chest.* The sensor operates best close to the belt.
- Place the sensor on a non-conductive (non-metal) surface, and away from electrical interferences. (See "Signal Loss and Interferences" on this card.) Do not place the sensor on metal or the ground. When you turn on the sensor, the first few data points may be erratic as the sensor locks onto the transmitter signal. Prior to data collection, conduct a test run to see how much interference is present in the area.

Signal Loss and Electrical Interferences

⚠ **CAUTION:** Do not place the sensor or transmitter belt around or on metal objects, next to computer consoles, on the ground or near electrical devices, magnets, power lines, television set, or other items emitting electromagnetic interferences. Also, do not wear the belt or sensor for underwater activities. Using the sensor or belt around metal or electrical devices may interfere with measurement accuracy. Immersing the sensor in water may permanently damage the sensor.

⚠ **CAUTION:** Excessive sensor or belt movement will affect measurement accuracy. Erratic measurements, or large reading fluctuations, such as a drop to 0 bpm or sudden increase to 240 bpm, indicate signal loss. If signal loss occurs, rewet the electrodes, check electrode contact (and/or tighten the belt), and move the sensor closer to the transmitter. The most common causes of signal loss are belt movement, inadequate electrode contact, improper sensor orientation, or too large a distance between the transmitter and receiver.

Experiment Suggestions

- Heart rate, respiration, and skin temperature during exercise
- Effect of exercise training on resting and exercise heart rate (long-term studies)
- Comparison of exercise heart rate for various forms of exercise (aerobic vs. anaerobic, high resistance vs. high repetition weight training)
- Exercise recovery rates (trained vs. untrained individuals)
- Exercise heart rate and maximum oxygen uptake
- Exercise heart rate in healthy and diseased populations